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# Early maternal work and child vocabulary development: evidence from Ethiopia

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**ABSTRACT**

This paper uses Young Lives Survey data to examine the relationship between early maternal work and child vocabulary development at age 5 in Ethiopia. In bivariate analysis, early maternal work in agriculture, self-employment and single or multiple work activities are negatively associated with vocabulary development at age 5. However, when children are matched on child, maternal and economic context characteristics using entropy balancing only maternal work in multiple activities remains significantly associated. Analysis of the association between the matching variables and maternal work characteristics indicates that children whose mothers did not work in their child's first year of life belong to wealthier households, their mothers have higher levels of education and they are more likely to reside in urban areas – factors which are all also strongly associated with better vocabulary development. Our results suggest that in the case of most maternal work types, it is the factors which select mothers into work, rather than maternal work itself, which are negatively associated with vocabulary development. Particular attention needs to be paid to mothers who juggle multiple work activities alongside caring for young infants, and more broadly policy should focus on enabling low-income women to access high quality and equal education and employment opportunities.

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## Introduction

Early childhood development has a strong influence on future wellbeing, including economic development at the national level as well as the educational and labour market outcomes of individuals (Hanushek & Woessmann, 2008). Consequently, early childhood development has been identified as a priority area for achieving many of the United Nation's Sustainable Development Goals (Black et al., 2017; Woodhead, 2016). Nonetheless, conservative estimates indicate that 250 million children in low and middle-income countries are not meeting their development potential raising concern about the

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challenge of creating equitable early childhood policies and programs that reach those most in need (Black et al., 2017). Female labour force participation has been increasing globally and is also central to policy discussions around achieving the Sustainable Development Goals, as a vehicle for gender equality, female empowerment and economic growth (Verick, 2014). However, research, predominately from the US, has shown that maternal labour force participation in the first year of life can be a risk factor for subsequent development amongst infants (Baum, 2003; Baydar & Brooks-Gunn, 1991; Blau & Grossberg, 1992; Brooks-Gunn et al., 2002; Han et al., 2001; Waldfogel et al., 2002). Experiences of work, family and care are entwined in socio-cultural and economic context and thus it is unclear how such findings translate to resource-constrained contexts. This paper focuses on Ethiopia – a country where less than half of adults are literate (UNICEF, 2016), only approximately one in every two children finish primary school (UNICEF, 2018) and where despite high female labour force participation, gender inequality is a prominent feature of the labour market (World Bank, 2019). Child development consists of perceptual, motor, cognitive, language (vocabulary), socio-emotional and self-regulation skills. The analysis in this paper focuses on furthering the limited research on the relationship between early maternal work and child vocabulary development in low and middle-income countries (LMICs). We consider how the relationship may vary by contextually relevant work characteristics, namely the type of employment and number of economic work activities, and how childcare strategies are correlated with maternal work patterns and child vocabulary development. The following sections outline current theories and empirical evidence on the relationship between early maternal economic activity and child vocabulary development and their relevance to LMICs, and contextual information on Ethiopia. Informed by this literature review we present hypotheses for the study. The final sections of the paper discuss the findings and resulting implications for supporting child vocabulary development and women's work in Ethiopia and similar resource-constrained contexts.

## *Early maternal work and child development: impact on child-caregiver relationship*

The very earliest studies on the relationship between early maternal work and child development theorized that the potential separation of mothers and young children as an outcome of maternal work could have consequences for the formation of secure mother-infant attachment. This research on maternal work and attachment relationships has provided varied results with some studies suggesting no effect (for example, Chase-Lansdale & Owen, 1987), some finding that children placed into early childcare were at risk (for example, Barglow et al., 1987), and others finding that childcare can have positive effects on attachment (for example, Cárcamo et al., 2016). Several empirical studies have shown that when mothers work full-time this has more adverse consequences for child development than when mothers work part time (Brooks-Gunn et al., 2002; Gregg & Washbrook, 2003), suggesting the impact of the quantity of time mothers and infants spent together may be a driving factor of the relationship between early maternal work and child development. Yet, the quantity of time mothers spend with children may not impact cognitive development. The Panel Study of Income Dynamics in the United States found that maternal economic work had no effect on time spent on

activities that have benefit for child cognitive development, such as educational activities, and instead there was a reduction in time spent in activities such as unstructured television watching with children (Hsin & Felfe, 2014). A similar finding has also been reported by Huston and Aronson (2006) based on time-use diaries of mothers of young infants.

Furthermore, not all work circumstances result in the separation of mothers and children. For example, drawing on data from Northern England Baines and Gelder (2003) describe a sub-set of self-employed mothers whose main base of work being their home and their job flexibility allows them to schedule the demands of their work around their children. In LMICs, women are often engaged in informal entrepreneurial activities or agricultural work which do not necessarily imply separation from infants (Cassirer & Addati, 2007; Korotayev et al., 2016). For example, in the Nairobi slums, Kenya, Clark et al. (2018) identify three main care-providers for children as mothers, relatives and others and day care centres or creches. A third of working mothers in Clark et al.'s (2018) study identified themselves as the child's main childcare provider during the day, and as receiving little assistance, suggesting these women care for children whilst working.

Nonetheless, maternal labour force participation also has the potential to influence the quality of time that mothers spend with children. Drawing on the theory of role strain (Goode, 1960), maternal employment could result in a decline in the quality of the interactions with children if women experience exhaustion and overload from the combination of their work and family roles. Indeed, Cooklin et al. (2014) identified a relationship between the experience of work-family conflict and parenting behaviours in terms of less warmth and greater irritability in parent–child interactions. Furthermore, Han (2005) identified a negative impact of early maternal non-standard work patterns (such as evening and shift work) on child cognitive development, which may be linked to both quality and quantity of the time working mothers spend with infants. Cooklin et al.'s (2014) study however, revealed that the extent of work-family conflict reported by mothers was not the same, and the combination of maternal and work roles has the potential to benefit child–parent interaction, with a significant association being found between the experience of work-family enrichment and higher parenting consistency and parenting warmth. Whilst work-family conflict, strain and enrichment remains relatively under-studied in LMICs, the existing small body of literature suggests that some women in these contexts do experience conflict and strain when combining their multiple roles (Mkhize & Msomi, 2016; Rajadhyaksha & Smita, 2004; Waterhouse et al., 2017).

Relating to the debate on whether early maternal work interrupts the child–caregiver relationship is the childcare arrangements employed by mothers whilst they work. Bernal's (2008) analysis of employment and childcare decisions following childbirth in the US reveals negative associations between childcare use and cognitive development. However, the type of childcare arrangement can be important. In Gregg and Washbrook's (2003) UK study, the adverse effects of maternal employment were found to be particularly acute when mothers relied on unpaid childcare from family or friends, whereas infants who went to formal preschool were found to have better cognitive development than infants whose mothers did not work. Similarly, the negative effect of non-standard hours maternal employment in the US detected by Han (2005) was linked to

childcare arrangement, as the author found that mothers working irregular hours were less likely to use formal care arrangements such as preschools, which were identified as a positive factor for child cognitive development. In contrast, drawing on data from the US, Waldfogel et al. (2002) found that among mothers who worked more than 21 hours per week in the first year of their children's life, the use of centre childcare, along with nonrelative and relative care had greater negative effects. Considering the relevance of these theoretical and empirical contributions to LMICs, it is important to understand the context of mother-infant separations generally. For example, extended family care systems in a range of situations are more common in some communities and world regions and it is not necessarily the case that non-working mothers do not have or require childcare support. For example, Nakahara et al.'s (2006) study of working and non-working mothers and children's nutritional status in urban Nepal found that non-working mothers are not a homogeneous group when it comes to childcare support, and the assumption should not be made that non-working mothers do not require childcare support and non-working mothers can experience conflicts due to time and energy-intensive domestic tasks such as fetching water and fuel. Extended family support is not without its limitations, and several studies from LMICs have highlighted a desire amongst mothers to use formal childcare (Clark et al., 2018; Murungi, 2013). However, cost and availability can be significant barriers especially when women receive low and variable pay for their work (Grosse, 2016; Hallman et al., 2005). Further, the quality of crèches has been called into question as they are often unregulated (Clark et al., 2018). Cassirer and Addati (2007) assert that the overrepresentation of women in less profitable but more flexible informal forms of work which can be managed alongside physical childcare in LMICs may in fact be because of their lack of alternative options for childcare.

### *Early maternal work and child cognitive development: the context of maternal work*

Existing research has also suggested that the relationship between early maternal work and child cognitive development may be influenced by the broader economic context of maternal work. Vandell and Ramanan (1992) theorize that the relative balance of economic need, work stress and childcare availability associated with early maternal work may be different for families with different economic resources. Low household income is itself negatively associated with cognitive functioning in children (Noble et al., 2015). Economic hardship may translate into inability to source nutritious food or meet other basic needs such as housing and healthcare (Chaudry & Wimer, 2016) and, whilst strong parenting can be protective against adverse consequences, poverty is a risk factor for poorer parental mental health which may in turn influence parenting behaviours (Beeber & Miles, 2003).

Vandell and Ramanan (1992) highlight that studies of the relationship between early maternal work and child cognitive development show that mothers who work shortly after the birth of their infants in the US are different psychologically (e.g. less anxious about separation from their infant and more career driven) and demographically (e.g. higher family income). In Vandell and Ramanan's (1992) study exclusively amongst low-income families, they found a positive relationship between early maternal work

and child cognitive development. The authors suggest this may be related to the broader ecological context of their sample – for families experiencing economic hardship, the ability of earnings from early maternal work to relieve the economic and psychological impacts of poverty outweigh the negative consequences. However, support for this theory is inconclusive. For example, although Greenstein (1995) hypothesized that the negative effects of early maternal work might only exist for most advantaged children the results of their study also in the US did not support this, finding that more and less advantaged children with working mothers experienced similar negative consequences.

## *The context of Ethiopia*

Despite strong economic development over the last decade, Ethiopia remains one of the poorest countries in sub-Saharan Africa and is classified by the World Bank as a low-income country (World Bank, 2019). In 2017, it was ranked 173 out of 189 countries in terms of its Human Development Index score, which takes into account standards of living, access to knowledge and long and healthy life expectancy (UNDP, 2018). Whilst Ethiopia has been cited as one of the most equal countries in the world, geography still matters with more remote areas being characterized by greater poverty (World Bank, 2015a). World Bank data shows that more than one-quarter (27.4%) of the population in Ethiopia lived in poverty ($1.90 PPP a day) in 2015, compared for example to 1.2% in the US, highlighting very different contexts in terms of absolute poverty of maternal work in low- and high-income settings (World Bank, 2015b).

Female labour force participation in Ethiopia in 2017 was 77% up from 66% in 1990 (World Bank, 2018a), indicating work has been a continued majority experience for women in this context. Ethiopia is a predominantly rural society, and agriculture accounts for 60% of all female employment (World Bank, 2018b). Female labour force participation is lower in urban areas compared to rural areas, and urban female unemployment is double that of males (Kibret, 2014). Desta (2013) attributes the higher level of labour force participation of women in rural areas to the fact agricultural work is more flexible, located near home, often seasonal only, and many women farm with children on their backs enabling them to provide physical care as they work.

Gender inequality characterizes women's work in both rural and urban areas. Farming is a gendered task, with plowing, sowing and threshing seen as masculine activities (Tadele & Gella, 2014). Women participating in these activities are viewed as 'bodies out of place' (Tadele & Gella, 2014, p. 14) and these blurring of gender boundaries are described to only occur where men are absent from the households. Aguilar, Carranza, Goldstein, & Oseni's (2015) decomposition of gender differences in agricultural productivity, using the 2011–2012 Ethiopian Rural Socio-economic Survey, found a 23% bias in favour of male compared to female land managers. This trend was heavily influenced by the lower productivity of unmarried, especially divorced, female farm managers and attributed to factors such as fewer inputs and smaller plots of land. In urban areas, women are largely excluded from formal employment. They make up a substantial proportion of small-scale entrepreneurs in the service sector (Belwal et al., 2011), yet they face constraints and disadvantage with regards to gender inequality and discrimination in access to education, training, market information, credit, and technology. Income

diversification is common in Ethiopia, particularly among farm households. Research from Southern Ethiopia indicates that the participation of women in multiple livelihood activities is frequent, with 46% of women surveyed in an agricultural community reporting having two or more activities with trading being an important secondary activity (Carswell, 2002). Whilst involvement in multiple occupations is often theorized to spread risk by diversifying income sources, research in the Somali region indicated that households involved in multiple livelihood strategies are often the poorest (Devereux, 2006). Indeed, Beyene's (2008) study found that women in farm households with children present are more like to also be involved in off-farm activities, which they suggest may be due to the need of additional income.

Ethiopian tradition dictates that new mothers should stay within the home, and recover after childbirth, for a period of 40 days. The reality is, however, that the ability to do this varies depending on the socio-economic status of the woman (Warren, 2010). Section 88 of The Constitution of Ethiopia Labour Proclamation guarantees women working in the formal sector fully paid maternity leave of three months (30 days antenatal and 60 days post-delivery) (International Labour Organisation, 1993). Nonetheless, women are largely excluded from formal sector employment and not entitled to maternity leave. Mothers assume primary caregiving responsibilities and provide physical care for young children, although may receive support from other family members, particularly females (Sunter, 2018). Indeed, the extended family is a well-established social security system in Ethiopia as it is across much of sub-Saharan Africa, although it is not without its limitations (Germann et al., 2009). Waldfogel et al. (2002) note that in the US context non-maternal caregiving is far more common in children whose mothers return to work than other children. This relationship may not be as strong in Ethiopia where there is a stronger tradition of kin providing childcare support.

In both rural and urban areas of Ethiopia, other children, particularly girls, are also important sources of childcare (Samman et al., 2016; Sunter, 2018). Survey data suggests that approximately a half of children aged 5–8 years in rural areas have provided some form of childcare, whilst this figure for children residing in urban areas is less at a third. These figures increase to 70% of 13–17 years old in rural areas and 55% in urban areas. There are stark differences in fertility in rural and urban areas which may explain the reduced reliance on other children for support with childcare in urban areas: one analysis showed that the total fertility rate in Addis Ababa, the capital city, stood below replacement level at just 1.9 children per woman (Gurmu & Mace, 2008). In urban areas, young domestic maids are important sources of childcare for households with higher socio-economic status (Erulkar & Mekbib, 2007). Further, there has been a recent expansion in daycare centres for infants in urban areas, although early research on care provision in these services suggests a lack of rigour in professional standards (Tefera & Yesus, 2015). Primary school begins at age seven in Ethiopia but the government has a plan to provide pre-primary early childhood care and education for all children by 2030. As such private and public kindergartens for children aged 3–6 years are increasingly becoming available especially in the urban areas, with better-off parents being able to select private kindergarten, which provide superior quality care (Samman et al., 2016).

### Research hypotheses

Based on theories and findings from the international literature combined with contextual information on the nature of work, family and care in Ethiopia, we propose the following hypotheses to be tested in the empirical work:

(1) Overall, early maternal economic work status will not be associated with child verbal development amongst a sample of pro-poor households in Ethiopia.

The evidence from HICs suggests that in situations of economic deprivation the disadvantages of early maternal employment are balanced by the positive material effects of maternal employment. Whilst evidence from LMICs is scarce, Burroway's (2017) analysis of women's employment and a different child development outcome – malnutrition – in 49 developing countries found no significant association when using a simple measure of women work.

(2) Children's whose mothers are self-employed or engaged in multiple economic activities will be most vulnerable to poor verbal development.

For the Ethiopian context, these work characteristics are indicative of a particular disadvantage. Self-employment, typically linked to small-scale enterprises in the services sector is a precarious form of employment which in some circumstances can be more challenging to combine with physical childcare than agricultural work and is without the protections and rights afforded to formal sector workers. Relying on multiple economic activities is likely to be indicative of irregular hours, higher levels of stress and lower earnings.

(3) The use of childcare will not be disproportionate amongst mothers engaged in economic activity.

The evidence from Ethiopia is that non-maternal caregiving for infants is common amongst working and non-working mothers.

## Methods

### Data

This paper draws on secondary survey data from Young Lives; an international longitudinal cohort study of child welfare coordinated out of the UK Department of International Development at the University of Oxford (Young Lives, 2019). Data from the Ethiopian Younger Cohort collected in 2002 (Wave 1) and 2006 (Wave 2) (Boyden, 2014; Huttly & Jones, 2014) when children were 6–17 months and 4.5–5.5 years, respectively, were utilized. Wave 1 collected data on 1,999 young children, sampled from twenty purposely identified sentinel sites located in the five major regions of Ethiopia; Amhara, Oromia, SNNPR and Tigray and the capital Addis Ababa (Wilson et al., 2006). The sentinel sites were selected to be over-representative of poor households and to provide a mixture of rural and urban areas. From the sentinel

sites, 100 households with a child born in 2001–2002 were randomly selected to take part in the younger cohort survey. As no pre-existing sampling existed, the first stage of sampling in these areas involved 'screening' of an area for eligible households (Wilson et al., 2016, p. 361). Only children who were singleton were eligible, and where there was more than one eligible child present in a household one child was randomly selected. In the first wave, there was no non-response for participation in the survey. At wave one information was collected from the primary caregiver of the child on information such as details of household members including their livelihoods, pregnancy, delivery and breastfeeding, childcare in the six months preceding the survey, child health and anthropometry, socio-economic status and social capital. Households and children were revisited in 2006 for participation in wave 2, and resulted in 95.7% of the original younger cohort sample completing questionnaires (Woldehanna et al., 2008). At wave two the household questionnaire completed by a family member collected information such as household members, the child's parental background, assets, time allocation of children and adults, social capital, child health and anthropometry, socio-economic status, childcare activities and education of child. Whilst the data was collected a considerable period of time ago, it is unique in collecting detailed information on circumstances at the start of life and subsequent development in an LMIC.

Wave 1 of the dataset consists of 1999 children aged between 6 and 17 months. The analytic sample for this paper was restricted to children for whom their primary caregiver was their biological mother and were aged 12–17 months at the time of the wave 1 interview ($n = 1013$). We restricted the analytical sample to only infants aged at least 12 months because the measure of early maternal work in wave 1 was based on activities in the 12 months preceding the survey and as our focus was on maternal economic work during infancy. In addition, 39 infants were excluded as they were lost to follow up between waves, and a further 63 were excluded as they had missing data for one or more variables used in the study. The final sample for this paper included 911 infants. Children not included in the final analytical sample were more likely to have a long-term health condition (12% compared to 9% in the final sample, $p < 0.05$). Those not included in the final sample were more likely to have younger mothers (37% of mothers aged less than 25 years compared to 32% of mothers in the final analytical sample, $p < 0.05$) and were likely to have mothers who reported working at wave 1 (45% versus 40%, $p < 0.05$). No significant differences were found in terms of the child's sex, birth size, maternal education, wealth or region of residence.

### *Vocabulary development measure*

The outcome, vocabulary development, was measured at wave 2 (when children were aged 4.5–5.5 years) using the Peabody Vocabulary test (PPVT). The PPVT is a widely used test of verbal ability, which requires individuals to pick the picture which best embodies the word being spoken by the examiner with subsequent words being of increasing difficulty (Dunn & Dunn, 2007). Standardized age-specific z-scores were created so that children of different ages could be compared. These were constructed by subtracting the month-of-age-specific mean from the raw PPVT score and dividing by the month-of-age-specific standard deviation.

### Maternal work characteristics

Maternal work was measured at wave 1. Participants were asked to record the three most important activities they had done in the 12 months preceding the survey in terms of earning money or goods for themselves or for their households and to survive day to day. Previous literature from HICs highlight differences by contextually relevant maternal work characteristics, namely full- or part-time work (Brooks-Gunn et al., 2002; Gregg & Washbrook, 2003), and shift/irregular work (Han, 2005). This paper employs maternal work characteristics variables informed by the nature of women's work in Ethiopia. In addition, to a binary 'working' or 'not working' variables reflecting work sector: 'not working', 'agriculture', 'self-employed' and 'working for others', and number of work activities: 'none', 'single' and 'multiple' were utilized. For the work sector, those whose activity description was coded as 'Agriculture' or 'Hunting' by the Young Lives team were categorized as working in agriculture. Those not working in agriculture were categorized as 'working for others' or 'self-employed' based on their answer to the question on whether or not they were employed by anyone. One-quarter of mothers who were categorized as working were involved in multiple activities. For these mothers, their work sector was based on their 'main' activity, identified based on the number of months in the last 12 months they had engaged in the activity, and within these months how many days per week they usually did the activity.

### Child, maternal and economic context variables

The child characteristics included in the analysis were the child's sex, birth order, mother's perception of birth size, main language and whether the mother reported the child had a long-term health problem. Birth weight of the children is commonly used to control for the initial endowment of skills. Due to the large percentage of missing data for this variable in the Young Lives data, maternal perception of child's birth size (small, average or large) was used as a proxy for birth weight. Previous research by Channon (2011) using Demographic and Health Survey data from three countries has found maternal perception of birth size to be a good proxy for birth weight. The maternal characteristics were mother's age and mother's highest level of education. The economic context characteristics were household wealth and residence (rural or urban). The data includes a wealth index based on housing quality (for example, type of floors and walls), ownership consumer durables (for example, fridge and bike) and services (for example, source of water). This was divided into quintiles to create the measure of household wealth. All information for these measures was taken from the wave 1 survey, apart from the main language and birth order variables where the information was collected in the wave 2 survey.

### Statistical analysis

Chi-squared tests for independence were used to assess the significance of the bivariate associations between the child, maternal and economic context variables and the maternal work variables. Independent samples t-tests were used to assess the association between maternal work characteristics and vocabulary development at age 5. It is likely that children exposed to early maternal work differ to children not exposed to early maternal work and that these differences may also be associated with vocabulary

development. In order to seek to address this possible selection bias, entropy balancing was used to examine the relationship between vocabulary development at age 5 and maternal work characteristics. This matching approach is a multivariate reweighting method which focuses on covariate balance (Hainmueller, 2012). Taking a matching approach means it is possible to compare the vocabulary development of children with a particular maternal work characteristic to similar children whose mothers did not work. Children were matched on the child, maternal and economic context characteristics. As described previously all these characteristic variables were categorical and treated as such in the matching. A table showing the distribution of the weighted variables is provided in Table A1 in appendix. Matching was based on the means (first moment). Two models were calculated. A first model that uses the entropy balancing weight without matching variables as covariates, and a second model which uses the entropy balancing weight with the matching variables as covariates. Including matching variables in the second model increases the precision of estimates which is important in small samples such as in this study.

A key assumption of matching techniques is that the matching covariates are measured before exposure to the treatment (in this case, early maternal work). In this study, the matching variables were based on information collected at the same time as information on the treatment, as the dataset did not collect data at an earlier timepoint or ask retrospective questions. However, the matching variables used in this study are mainly time invariant. It is possible that the child long-term health condition and maternal education variables could be different from their value before the mother started working; however, they are unlikely to have changed (especially as education has been classified by level rather than years) and it is highly unlikely that they would have been directly influenced by maternal work. The largest risk of reverse causality is for the household wealth variable. However, it is based on asset data which is known to represent the long-term socio-economic position at the household level (Howe et al., 2008). The analysis is conducted using the STATA 'ebalance' command and using the default tolerance level of 0.015.

A limitation of this approach is that it does not account for any unobserved factors which may relate both to maternal work characteristics and child vocabulary development, although a rich set of observed matching variables are included. As a robustness check, the potential bias of unobserved factors was considered using a method suggested by Oster (2019) and conducted using the 'PSACALC' command in STATA. This method exploits the notion that bias from observed factors provides information about unobserved bias assuming proportionality between both biases. Information on coefficient and R-square movements in ordinary least square regression models were used to create bounds for β. Table A2 in the appendix presents the results of this robustness check.

In order to explore the association between the matching variables and the age-standardized PPVT scores, bivariate inferential statistical tests were used to assess the significance of differences in age-standardized PPVT scores by the matching variables. Independent sample *t*-tests were used for binary matching variables and Kruskal–Wallis Tests were used for variables with three or more categories (selected over one-way ANOVA as all variables violated the equal variance assumption). In addition, in order to provide a measure of the strength of the association between variables effect sizes (Cohen's *D*) were calculated using a widely cited effect size calculation website (Lenhard & Lenhard, 2016).

### Childcare analysis

In order to examine childcare arrangements by maternal work status, a variable to describe support with childcare in the first year of life was derived. The variable was based on information on regular childcare support (defined as almost every week for a whole morning, afternoon, evening or night) provided in the household roster and responses to questions on non-household childcare. The variable had the categories: no childcare support, childcare support from children only (<15 years) and childcare support including adult caregivers. The final variable did not distinguish between household and non-household support as the majority of children who received non-household childcare also received regular childcare from household members. Chi-Squared Tests for Independence were used to assess the association between the childcare support variable and the maternal work characteristic variables, and a Kruskal–Wallis test was used to examine whether age-standardized PPVT score at age 5 varied by childcare support in the first year of life. All statistical analyses were conducted using STATA software version 14 (Stata Corp. Inc, TX, USA).

## Results

### Child, childcare, maternal and economic context characteristics & maternal work during the first year of life

Table 1 displays the child, maternal and economic context characteristics by the maternal work characteristics, as measured at wave 1. These are the unmatched percentages before weighting by entropy balancing was applied. Overall, 60.0% of infants were exposed to early maternal work. Consistent with previous literature, agricultural work and self-employment are more common than working for others, and a minority of mothers were engaged in multiple activities: 14.9% mothers were engaged in multiple work activities compared to 45.1% engaged in a single work activity. Further analysis of the reported activity of those defined as self-employed (not shown) reveals that the majority work in manufacturing (34.3%, specifically 26.3% in food and beverage manufacturing) and retail trade (30.6%). This reflects results from the third wave of the Ethiopia Socio-economic Survey (ESS) (2015–2016), a nationally representative survey, which found that 34% and 21% of women enterprises in Ethiopia were in manufacturing or trade (World Bank, 2019). The World Bank (2019) notes that female enterprises in Ethiopia tend to be characterized by lower profitability compared to those of men. In our sample, 9.3% of children had mothers who were defined as working for others. This low level is consistent with findings from the World Bank who report wage and salaried female workers as 10.9% of total female employment in Ethiopia (The World Bank, 2020). In our sample children with mothers reporting that they worked for others, approximately one third reported working in services, including 8% in public administration. The majority (39%) reported working in 'other business activity'. Results from the ESS found among employees, those who reported a paid job in the month preceding the survey, for women this form of employment in Ethiopia is concentrated in services (37%) (World Bank, 2019). Whilst female wages in Ethiopia are lower compared to males on average (World Bank, 2019), they may provide a more regular and stable income compared to women with precarious small-scale enterprises.

**Table 1.** Child, maternal and economic context characteristics by maternal work characteristics during child's first year of life.

| | Maternal work characteristics (child age 1) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Not working | Working *(all)* | Agricultural work | Self-employed work | Working for others | Single work activity | Multiple work activities | Total |
| | Column % | Column % | Column % | Column % | Column % | Column % | Column % | Column % |
| Child characteristics (child age 1) | | | | | | | | |
| *Sex* | | | | | | | | |
| Male | 55.8 | 53.4 | 57.7 | 49.1 | 51.8 | 52.1 | 57.4 | 54.3 |
| Female | 44.2 | 46.6 | 42.3 | 50.9 | 48.2 | 47.9 | 42.7 | 45.7 |
| *Birth order* | | ** | ** | ** | | ** | ** | |
| First | 28.0 | 16.1 | 14.2 | 13.4 | 28.2 | 17.5 | 11.8 | 20.9 |
| 2nd or 3rd | 34.1 | 36.2 | 36.2 | 35.7 | 37.7 | 33.6 | 44.1 | 35.4 |
| 4th or greater | 37.9 | 47.7 | 49.6 | 50.9 | 34.1 | 48.9 | 44.1 | 43.8 |
| *Main language* | | | | | | | * | |
| Other | 58.8 | 54.3 | 55.3 | 54.2 | 51.8 | 57.9 | 43.4 | 56.1 |
| Amharic | 41.2 | 45.7 | 44.7 | 45.8 | 48.2 | 42.1 | 56.6 | 43.9 |
| *Child has long-term health condition* | | | | | | | | |
| Yes | 11.8 | 11.9 | 12.2 | 12.5 | 9.4 | 11.4 | 13.2 | 11.9 |
| No | 88.2 | 88.1 | 87.8 | 87.5 | 90.6 | 88.6 | 86.8 | 88.1 |
| *Maternal perception of child's birth size* | | | | | | | | |
| Small | 30.2 | 29.4 | 29.4 | 34.3 | 20.0 | 29.0 | 30.9 | 29.8 |
| Average | 40.7 | 42.4 | 42.2 | 31.9 | 51.8 | 42.8 | 41.2 | 41.7 |
| Large | 29.1 | 28.2 | 28.2 | 33.8 | 28.2 | 28.2 | 27.9 | 28.5 |
| *Age-standardized PPVT scores (at age 5)* | | ** | ** | * | | * | ** | |
| Mean (SD) | 0.17 (1.01) | −0.11 (0.97) | −0.33 (0.59) | −0.08 (0.95) | 0.44 (1.52) | −0.03 (1.05) | −0.37 (0.62) | 0.00 (1.00) |
| Maternal characteristics (child age 1) | | | | | | | | |
| *Maternal age (yrs)* | | | | * | | | | |
| <25 | 34.9 | 29.4 | 36.6 | 24.1 | 22.4 | 29.7 | 28.7 | 31.6 |
| 25–34 | 49.5 | 50.8 | 46.8 | 51.9 | 60.0 | 50.9 | 50.7 | 50.3 |
| 35+ | 15.7 | 19.7 | 16.7 | 24.1 | 17.7 | 19.5 | 20.6 | 18.1 |
| *Maternal education* | | ** | ** | ** | | ** | ** | |
| None | 45.1 | 65.8 | 77.6 | 64.4 | 35.3 | 63.8 | 72.1 | 57.5 |
| Primary | 30.5 | 22.3 | 19.1 | 23.6 | 28.2 | 21.9 | 23.5 | 25.6 |
| Secondary | 24.5 | 11.9 | 3.3 | 12.0 | 36.5 | 14.4 | 4.4 | 16.9 |
| Economic context (child age 1) | | | | | | | | |
| *Household wealth* | | ** | ** | ** | | ** | ** | |
| Poorest | 10.7 | 27.4 | 26.8 | 35.2 | 9.4 | 20.4 | 48.5 | 20.8 |
| Poor | 15.1 | 21.8 | 31.3 | 17.1 | 5.9 | 21.7 | 22.1 | 19.1 |
| Middle | 18.1 | 21.2 | 32.5 | 9.7 | 17.7 | 24.1 | 12.5 | 20.0 |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Rich | 23.4 | 18.1 | | 8.5 | | 25.5 | | 27.1 | | 19.7 | | 13.2 | | 20.2 |
| Richest | 32.7 | 11.5 | | 0.8 | | 12.5 | | 40.0 | | 14.1 | | 3.7 | | 20.0 |
| *Area of residence* | | | ** | | ** | | * | | ** | | ** | | ** | |
| Urban | 45.1 | 27.8 | | 3.7 | | 35.2 | | 78.8 | | 32.1 | | 14.7 | | 34.7 |
| Rural | 55.0 | 72.2 | | 96.3 | | 64.8 | | 21.2 | | 67.9 | | 85.3 | | 65.3 |
| **Total column percentage** | 100 | 100 | | 100 | | 100 | | 100 | | 100 | | 100 | | 100 |
| **Percentage of sample** | 40.0 | 60.0 | | 27.0 | | 23.7 | | 9.3 | | 45.1 | | 14.9 | | – |
| *N* | 364 | 547 | | 246 | | 216 | | 85 | | 411 | | 136 | | 911 |

Notes: Chi-Squared Tests for Independence used to assess significance of associations. All comparison are made against not working as a reference group $^{**}p < 0.001$, $^{*}p < 0.05$.

In terms of the characteristics of the sample, the majority of children did not have a reported long-term health condition (88.1%). Approximately one-fifth of children were the first-born, whilst just under 50% were the fourth or greater born. Over half of children had mothers who reported no education, whilst one-quarter had mothers with primary education. Half of children had mothers aged between 25 and 34 years.

Maternal age, maternal education, household wealth and residence (rural or urban) all differed significantly by maternal work characteristics. Children whose mothers were self-employed had older mothers than children whose mothers did not work ($p < 0.05$). In terms of education, a greater percentage of mothers working in agricultural work, self-employment, and had a single or multiple work activities had no education compared to non-working mothers ($p < 0.001$). In terms of wealth, in comparison to non-working mothers, those engaged in agriculture or self-employment are more likely to reside in poorer households ($p < 0.001$). Differences exist in maternal sector of employment by area of residence. Agricultural employment is associated with rural residence, whilst working for others is more common in urban areas ($p < 0.001$). Multiple work activities are also associated with rural residence ($p < 0.001$). These differences between groups in the unweighted sample show there are clear observable differences between children whose mothers had different work patterns. Table A1 (located in the appendix) shows these differences no longer exist once the entropy balancing weights have been applied.

## *Early maternal work and child cognitive development*

Figure 1 displays the mean age-standardized PPVT score for children at age 5 by maternal work characteristics during the child's first year of life. Children whose mothers were engaged in agricultural work, self-employed work, single or multiple work activities had significantly lower PPVT scores at age 5 ($p < 0.05$). Although the mean PPVT score of children whose mothers were defined as 'working for others' in this sample is higher than the mean PPVT score for children whose mothers did not work, there is a large margin of error and the t-test indicated that the difference is not statistically significant.


**Figure 1.** Mean(+/−95% C.I.) age-standardized PPVT score at age 5 by maternal work characteristic during child's first year life. Note: Asterisks show independent sample t-test result for children with each maternal work characteristic relative to the 'not working' group. $^{**}p < 0.001$, $^{*}p < 0.05$.

Table 2 shows the results of the entropy balancing. The column headed Models A presents the models that use the entropy balancing weight without matching variables included as covariates. The column headed Models B presents the models that use the entropy balancing weight with the matching variables included as covariates. There are minimal changes in the coefficients across the two sets of models. The conclusions of the entropy balancing are consistent with those that can be inferred from ordinary least square models (Table A2 in the appendix) that include the aforementioned child, maternal and economic contextual variables as controls. The results broadly support hypothesis 1, that overall early maternal work will not be associated with child verbal development. These results indicate that after matching on child, maternal and economic context characteristics, the binary measure of maternal work is not significant. Only partial support is provided for hypothesis 2, that children whose mothers are self-employed or engaged in multiple economic activities will be most vulnerable to poor verbal development. Table 2 indicates that after matching on child, maternal and economic characteristics that in addition to children whose mothers worked for others, children whose mothers are self-employed, work in agriculture, or are engaged in a single work activity have similar (i.e. not significantly different) vocabulary development scores at age 5 to children whose mothers did not work in their first year of life. This is contrary to the negative bivariate associations between these variables displayed in Figure 1. However, Table 2 does show that maternal engagement in multiple work categories remains negatively associated with child vocabulary development ($p < 0.05$) even after matching on child, maternal and economic context characteristics. Sensitivity

**Table 2.** Entropy balancing models showing the association between maternal work characteristics in the first year of the child's life and standardized PPVT scores at age five.

| | *N* | MODELS A: No covariates | | | | MODELS B: All matching variables as covariates | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Coefficient | S.E | *P*-value | | Coefficient | S.E | *P*-value | |
| **Maternal work status** | | | | | | | | | |
| Not working (ref) | 364 | | | | | | | | |
| Working | 547 | −0.092 | 0.071 | 0.196 | | −0.092 | 0.062 | 0.142 | |
| *R*-squared | | *0.002* | | | | *0.222* | | | |
| **Maternal work category** | | | | | | | | | |
| Not working (ref) | 364 | | | | | | | | |
| Agriculture | 246 | −0.132 | 0.086 | 0.126 | | −0.132 | 0.074 | 0.074 | |
| *R*-squared | | *0.012* | | | | *0.105* | | | |
| Not working (ref) | 364 | | | | | | | | |
| Self-employed | 216 | −0.065 | 0.089 | 0.464 | | −0.064 | 0.077 | 0.403 | |
| *R*-squared | | *0.001* | | | | *0.245* | | | |
| Not working (ref) | 364 | | | | | | | | |
| Working for others | 85 | 0.082 | 0.184 | 0.657 | | 0.081 | 0.163 | 0.620 | |
| *R*-squared | | *0.001* | | | | *0.201* | | | |
| **Number of work activities** | | | | | | | | | |
| Not working (ref) | 364 | | | | | | | | |
| Single | 411 | −0.029 | 0.075 | 0.694 | | −0.029 | 0.065 | 0.656 | |
| *R*-squared | | *0.000* | | | | *0.223* | | | |
| Not working (ref) | 364 | | | | | | | | |
| Multiple | 136 | −0.290 | 0.092 | 0.002 | * | −0.289 | 0.079 | <0.001 | ** |
| *R*-squared | | *0.042* | | | | *0.216* | | | |

Notes: Models matched on child's sex, maternal perception of child's birth size, whether the child had a long-term health condition, main language, maternal age, maternal education, household wealth quintile and rural or urban residence.
**$p < 0.001$.
*$p < 0.05$.

analysis using methods proposed by Oster (2019) suggests the results are robust to the potential bias of unobserved factors. Table A2 reports the results of this bounding exercise and for all measures of maternal work the identifying bound (column 4) is within the 95% confidence interval bound of coefficient in the models re-weighted using entropy matching and including all controls (column 2).

To explore which child, maternal and economic characteristics are important in rending the relationship between child vocabulary development and the binary measure of work, agricultural work, self-employment and single work category insignificant, the associations between these variables and child vocabulary development were assessed (Table 3). The results show that there are significant differences in child mean standardized PPVT scores by the child's birth order, main language, maternal education, household wealth and area of residence ($p < 0.001$). Effect size is large for maternal education and household wealth. The effect size is deemed medium for the area of residence. Higher maternal education and higher household wealth are associated with higher mean PPVT scores at age 5. The mean PPVT score of children is highest for children resident urban areas (0.502), compared to rural areas (−0.266). Taken with the results presented in Table 1 showing that infants with higher maternal education, higher household wealth and urban residence are significantly less likely to have experienced early maternal work, this suggests that it is differences by maternal education, household wealth and area of residence between children with different early maternal work characteristics rather than maternal work characteristics themselves that were driving the bivariate associations with vocabulary development shown in Figure 1 but not evident in the entropy matching models.

### *Examining childcare arrangements by maternal work characteristics*

Table 4 shows childcare support by maternal work characteristics and mean age-standardized PPVT score at age 5. The results provide support for hypothesis 3, the use of childcare will not be disproportionate amongst mothers engaged in economic activity. It is evident that only a minority of infants across maternal characteristics were not cared for by others. Just over one in ten infants were also cared for only by other children (aged less than 15 years), while for the majority of infants, their non-maternal caregivers included adults. There are no significant associations between maternal work characteristics and childcare support (assessed using chi-squared test for independence), which supports hypothesis 3, that the use of childcare will not be disproportionate amongst mothers engaged in economic activity. Further, although the mean PPVT score is slightly lower for children who were cared for by other children only, the difference in the mean PPVT score at age 5 by childcare support is not statistically significant (assessed using a Kruskal–Wallis Test).

## Discussion

This study sought to explore how early maternal work relates to child vocabulary development in an LMIC focusing on differences by maternal work characteristics. Contrary to the common conclusion of studies from HICs, the Ethiopian evidence from a sample of pro-poor households suggests that it is predominately the maternal and economic

**Table 3.** Differences between mean standardized verbal tests score at age five by child, maternal and economic context variables ($n = 911$).

| Characteristic | *N* | Mean | Standard deviation | Test statistic[a] | *P*-value[a] | Cohen's *D* Effect Size[b] | Effect Size Category[c] |
|---|---|---|---|---|---|---|---|
| Child characteristics | | | | | | | |
| *Sex* | | | | 0.964 | 0.335 | 0.064 | N/A |
| Male | 495 | 0.030 | 1.058 | | | | |
| Female | 416 | −0.034 | 0.915 | | | | |
| *Main language*[d] | | | | −4.788 | <0.001 | 0.335 | Small |
| Other main language | 400 | 0.185 | 1.179 | | | | |
| Amharic | 511 | −0.144 | 0.796 | | | | |
| *Long-term health condition* | | | | 1.581 | 0.114 | 0.163 | N/A |
| No | 803 | 0.020 | 1.030 | | | | |
| Yes | 108 | −0.142 | 0.678 | | | | |
| *Birth order* | | | | 16.240 | <0.001 | 0.252 | Small |
| First | 190 | 0.225 | 1.154 | | | | |
| Second or third | 322 | 0.011 | 1.039 | | | | |
| Fourth or higher | 399 | −0.114 | 0.852 | | | | |
| *Birth size* | | | | 2.664 | 0.264 | 0.054 | N/A |
| Small | 271 | −0.077 | 0.917 | | | | |
| Average | 380 | 0.063 | 1.074 | | | | |
| Large | 260 | −0.010 | 0.953 | | | | |
| Maternal characteristics | | | | | | | |
| *Age (years)* | | | | 0.641 | 0.726 | 0.077 | N/A |
| <25 | 288 | 0.059 | 1.089 | | | | |
| 25–34 | 458 | −0.014 | 1.009 | | | | |
| 35+ | 165 | −0.060 | 0.769 | | | | |
| *Highest level of education completed* | | | | 155.089 | <0.001 | 0.901 | Large |
| None | 524 | −0.286 | 0.648 | | | | |
| Primary | 233 | 0.126 | 1.032 | | | | |
| Secondary or higher | 154 | 0.786 | 1.385 | | | | |
| Economic context characteristics | | | | | | | |
| *Household wealth* | | | | 175.430 | <0.001 | 0.966 | Large |
| Poor | 189 | −0.381 | 0.593 | | | | |
| Poorest | 174 | −0.299 | 0.543 | | | | |
| Middle | 182 | −0.214 | 0.803 | | | | |
| Rich | 184 | 0.200 | 1.070 | | | | |
| Richest | 182 | 0.696 | 1.312 | | | | |
| *Residence*[d] | | | | 10.229 | <0.001 | 0.721 | Medium |
| Urban | 316 | 0.502 | 1.226 | | | | |
| Rural | 595 | −0.266 | 0.719 | | | | |

[a]Independent samples *T*-Test used to test for difference for binary variables & Kruskal–Wallis test used to test for difference for variables with three or more categories (selected over one-way ANOVA because in all cases the equal variance assumption was violated).

[b]Cohen's *D* calculated directly for *T*-Test results & converted from eta-squared for Kruskal–Wallis test results to aid comparability (Lenhard & Lenhard, 2016).

[c]Effect Size: 0.2–<0.5: small, 0.5–<0.8 medium, 0.8+: large. Thresholds proposed by Cohen (1988) cited in Tomczak and Tomczak (2014).

[d]Denotes that the Levene's Test of Homogeneity of Variances was significant, so equal variance not assumed.

context factors which select mothers into early maternal work rather than maternal work itself which is negatively associated with child cognitive development.

The analyses of which child, maternal and economic context factors are associated with maternal work confirm that in Ethiopia mothers who work in the first year of their infant's life have significantly poorer education and are significantly more like to reside in poor households than mothers who did not work in this time period. This

**Table 4.** Childcare support by Maternal Work Characteristics & age-standardized PPVT score at age 5.

| | Maternal work characteristics (child age 1) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Not working | Working *(all)* | Agricultural work | Self-employed work | Working for others | Single work activity | Multiple work activities | Total Column % | Mean age-standarized PPVT score at age 5 |
| | Column % | Column % | Column % | Column % | Column % | Column % | Column % | | |
| No childcare support | 23.1 | 25.6 | 21.5 | 27.3 | 32.9 | 27.1 | 21.3 | 24.6 | 0.028 |
| Child care support includes children (<15 years) only | 11.5 | 12.6 | 11.8 | 13.9 | 11.8 | 12.4 | 13.2 | 12.2 | −0.132 |
| Child care support includes adults | 65.4 | 61.8 | 66.7 | 58.8 | 55.3 | 60.6 | 65.4 | 63.2 | 0.015 |
| **Total** | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 0.001 |

suggests decisions around early maternal work may be more out of necessity than the choice in low-income contexts such as Ethiopia. The exception to this is women who are working for others, the least common type of early maternal work. This highlights heterogeneity amongst children exposed to early maternal work and the importance of using nuanced contextually relevant measures of maternal work to identify vulnerable sub-groups.

The bivariate analyses of the association between early maternal work and child cognitive development show that early maternal work in agriculture, self-employment or multiple work activities during their first year of life are negatively associated with poorer vocabulary development at age 5. These work characteristics are not necessarily indicative of a reduction in the quantity of time infants and mothers spend together – for example, women engaged in agricultural work will often carry their children with them. Instead, these work characteristics are all indicative of lower economic returns and more precarious forms of work. It is a limitation of the study that it is not possible to directly look at maternal earnings; however, these findings do corrugate with the results of studies of the relationship between maternal employment and child nutrition in LMICs which have identified vulnerabilities amongst children whose mothers work in less profitable sectors and occupations (Brauner-Otto et al., 2019; Burroway, 2017). Whilst there is a significant difference in the mean age-standardized PPVT scores of those whose mothers are engaged in a single work activity compared to not working, the difference in means is small.

The matching analysis which compared children who experienced early maternal work in agriculture, self-employment or in a single work activity to children whose mothers did not work in their first year of life with similar individual, maternal and economic context characteristics showed that differences in age-standardized PPVT scores at age 5 years were not significant. Assessment of differences in mean age-standardized PPVT scores of children by the child, maternal and economic context characteristics revealed a significant difference and medium or large effect by maternal education, household wealth and area of residence. Maternal characteristics and economic context are well-documented and strong predictors of child development in LMIC (see for example Boo, 2015; Jeong et al., 2017; Paxson & Schady, 2005; Richards et al., 2018; Schady et al., 2015). Previous research from Chile also found that significant relationships between maternal work and child cognitive development were rendered insignificant once other factors were controlled for (Contreras & Gonzalez, 2015; Reynolds et al., 2017). Our analysis and the literature suggests that the vulnerabilities suggested by the bivariate analysis were only reflecting disadvantages of children whose mothers fell into the agricultural, self-employed or single work categories and there is there is no evidence of an additional negative effect of early maternal work once maternal characteristics and economic context are accounted for. This supports our first hypothesis that overall there will not be differences in child vocabulary development by early maternal work status in this context.

The exception to this is our finding that children whose mothers are engaged in multiple work activities have significantly lower verbal development than children whose mothers did not work, even in the matching analysis and after robustness checks to check for potential bias from unobserved factors. This provides partial support for our second hypothesis that children whose mothers are self-employed or engaged in

multiple economic activities will be most vulnerable to poor verbal development, proposed as these are indicative of more precarious and stressful forms of employment in this context. Whilst we found that differences between children with self-employed mothers and children whose mothers did not work were not significant once the analysis matched on child, maternal and economic characteristics, the disadvantage for children whose mothers were engaged in multiple work activities persisted. Above and beyond the fact that multiple work activities are often a precarious livelihood strategy, it may also result in overwork affecting maternal time and energy, in line with the theory of role strain (Goode, 1960). Understanding the particular situation of mothers engaged in multiple work activities in this context is an important avenue for future research.

This study found that childcare was not associated with maternal work activities, which supports our third hypothesis. This may relate to established norms around extended family childcare which are well-documented in Ethiopia as well as more widely in sub-Saharan Africa and other world regions including the Caribbean, which mean it is not uncommon for care of infants to be shared in a variety of circumstances. This is similar to Nakahara et al.'s (2006) finding of Nepalese mothers of young children that rough a third of both working and non-working mothers had no available childcare, although in this latter study the type of care adopted (caregivers less than 15 years of age and caregivers older) did vary by the work status of the mother. The measure of childcare was limited in the current paper, as in Nakahara et al. (2006), in that, no distinction was made between household and non-household care, and centre-based care, but this was due to limited numbers.

This study has further limitations that merit recognition. By using a static measure of maternal work this paper does not explore the cumulative impact of maternal work on child vocabulary development nor recognize the potentially dynamic nature of maternal work patterns. Kühhirt and Klein (2018) argue for the importance of using long-term measures of maternal work to capture timing and exposure effects especially given that in the case of vocabulary development there is no 'critical' period of development in early childhood. The Young Lives Survey did not contain detailed retrospective work histories to allow for the creation of nuance measures of stability of maternal work in early childhood. Whilst at wave 2 (collected five years after wave 1), information was collected on livelihoods of all household members, comparability to wave 1 is limited due to different question wording and structure. A measure based on only two time points five years apart would also have been limited in capturing the dynamic nature of maternal work. Detailed retrospective information about mothers, particularly measures of wealth and maternal work, prior to the birth of the child would also be an advantage to overcome potential issues with reverse causality.

## Conclusion and recommendations

Both child development and female labour force participation have been championed as vehicles for economic development; however, literature from HICs suggests maternal work in the first year of life may be a risk factor for child verbal development. The key academic contribution of this paper is to demonstrate that this is a context-

dependent finding. In poor households in Ethiopia, which operate under severe resources constraints but where support from non-maternal carers is common, the trade-off between the risks and opportunities associated with early maternal work is not negative for child verbal development for women engaged in single work activities and across different work sectors, results which have relevance for LMICs more broadly. However, the analysis highlights that children whose mothers are engaged in multiple work activities do have poorer verbal development – highlighting that for the Ethiopian context at least this early maternal work characteristic is indicative of heightened vulnerability. In common with other LMICs (Verick, 2014), working mothers in this study are disproportionally poorly educated and residing in the very poorest households. Wealth and maternal education have been found by previous studies to be strong predictors of child verbal development (Boo, 2015; Jeong et al., 2017; Paxson & Schady, 2005; Richards et al., 2018; Schady et al., 2015). Maternal employment could plausibly be a vehicle for transforming the wealth status of households if women were provided with access to high quality and equal employment opportunities. Therefore, there are several policy implications for supporting child cognitive development and maternal work in LMICs arising from this paper.

First and foremost, policy needs to tackle the root causes of gender inequalities in the labour market to enable women to reach their potential. This does not just include improving women's access to economic resources, such as credit for small- and medium-size enterprises, but also tackling inequality in the household by challenging gender norms and relations, for example in relation to decision-making (Wrigley-Asante 2011) and the household division of labour (UN Women 2018). Related to this, employment policy needs to support mothers in the labour force. The challenges of combining work and family are not well recognized in discourses in the region, and where policy does exist this often solely focused on women in the formal sector. The findings of this paper of working mothers residing in poorer households suggest that there may be constrained choices made by many women in returning to work, and this is likely to be felt most acutely by mothers juggling multiple work activities – the group whose infants were found to be vulnerable to poorer vocabulary development in this study even after accounting for other factors. This highlights the importance of expanding coverage of maternity leave beyond formal sector workers, a neglected area of the development agenda which disproportionally affects women (Mokomane, 2011; Mokomane, 2014).

Second, policy should focus on improving female education, as both a mechanism for improving female earning potential and a direct determinant of child development. There has been significant progress in increasing enrolment into school and reducing gender disparities under the Millennium Development Goals, but this focused on primary education (UN, 2017). Attention is being directed to increasing access and equality at all levels of schooling, including secondary schooling, under the Sustainable Development Goals. Challenges, nonetheless, exist particularly in Sub-Saharan Africa. Whilst there has been significant progress in enrolling children into primary education, this has not been matched by completion of primary education (UNICEF, 2018). Consequently, policy needs to not only consider enrolment into education but the quality of education and the longer-term progress and achievement of children and young people throughout school.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Data availability statement

The data that support the findings of this study are openly available in the UK Data Archive at https://doi.org/10.5255/UKDA-SN-6852-2, SN: 6852 and http://dx.doi/10/5255/UKDA-SN-5307-2, SN.5307

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## Appendix

**Table A1.** Child, maternal and economic contexts by maternal work characteristics in child's first year life, with entropy balancing weights applied.

| | Not working | Working | Not working | Agricultural work | Not working | Self-employed | Not working | Working for others | Not working | Single work activity | Not working | Multiple work activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Child characteristics (child age 1) | | | | | | | | | | | | |
| *Sex* | | | | | | | | | | | | |
| Male | 53.40% | 53.38% | 57.72% | 57.72% | 49.09% | 49.07% | 51.77% | 51.76% | 52.07% | 52.07% | 57.36% | 57.35% |
| Female | 46.60% | 46.62% | 42.28% | 42.28% | 50.91% | 50.93% | 48.23% | 48.24% | 47.93% | 47.93% | 42.64% | 42.65% |
| *Birth order* | | | | | | | | | | | | |
| First | 16.12% | 16.09% | 14.23% | 14.23% | 13.46% | 13.43% | 28.21% | 28.24% | 17.53% | 17.52% | 11.78% | 11.76% |
| 2nd or 3rd | 36.18% | 36.20% | 36.18% | 36.18% | 35.63% | 35.65% | 37.64% | 37.65% | 33.57% | 33.58% | 44.12% | 44.12% |
| 4th or greater | 47.70% | 47.71% | 49.59% | 49.59% | 50.90% | 50.93% | 34.14% | 34.12% | 48.90% | 48.91% | 44.11% | 44.12% |
| *Main language* | | | | | | | | | | | | |
| Other | 54.27% | 54.30% | 55.28% | 55.28% | 54.15% | 54.17% | 51.86% | 51.76% | 57.90% | 57.91% | 43.36% | 43.38% |
| Amharic | 45.73% | 45.70% | 44.72% | 44.72% | 45.85% | 45.83% | 48.14% | 48.24% | 42.10% | 42.09% | 56.64% | 56.62% |
| *Child has long-term health condition* | | | | | | | | | | | | |
| Yes | 11.88% | 11.88% | 12.19% | 12.20% | 12.50% | 12.50% | 9.41% | 9.41% | 11.44% | 11.44% | 13.23% | 13.24% |
| No | 88.12% | 88.12% | 87.81% | 87.80% | 87.50% | 87.50% | 90.59% | 90.59% | 88.56% | 88.56% | 86.77% | 86.76% |
| *Maternal perception of child's birth size* | | | | | | | | | | | | |
| Small | 29.44% | 29.43% | 28.45% | 28.46% | 34.26% | 34.26% | 20.02% | 20.00% | 28.96% | 28.95% | 30.87% | 30.88% |
| Average | 42.41% | 42.41% | 48.37% | 48.37% | 31.95% | 31.94% | 51.75% | 51.76% | 42.82% | 42.82% | 41.19% | 41.18% |
| Large | 28.15% | 28.15% | 23.17% | 23.17% | 33.79% | 33.80% | 28.23% | 28.24% | 28.22% | 28.22% | 27.94% | 27.94% |
| Maternal characteristics (child age 1) | | | | | | | | | | | | |
| *Maternal age (yrs)* | | | | | | | | | | | | |
| <25 | 29.45% | 29.43% | 36.59% | 36.59% | 24.09% | 24.07% | 22.38% | 22.35% | 29.69% | 29.68% | 28.69% | 28.68% |
| 25–34 | 50.82% | 50.82% | 46.75% | 46.75% | 51.85% | 51.85% | 59.98% | 60.00% | 50.85% | 50.85% | 50.73% | 50.74% |
| 35+ | 19.73% | 19.74% | 16.67% | 16.67% | 24.06% | 24.07% | 17.64% | 17.65% | 19.46% | 19.46% | 20.58% | 20.59% |
| *Maternal education* | | | | | | | | | | | | |
| None | 65.77% | 65.81% | 77.64% | 77.64% | 64.32% | 64.35% | 35.34% | 35.29% | 63.72% | 63.75% | 72.01% | 72.06% |
| Primary | 22.32% | 22.30% | 19.11% | 19.11% | 23.62% | 23.61% | 28.24% | 28.24% | 21.91% | 21.90% | 23.54% | 23.53% |
| Secondary | 11.92% | 11.88% | 3.25% | 3.25% | 12.06% | 12.04% | 36.42% | 36.47% | 14.37% | 14.36% | 4.46% | 4.41% |
| Economic context (child age 1) | | | | | | | | | | | | |
| *Household wealth* | | | | | | | | | | | | |
| Poorest | 27.39% | 27.42% | 26.83% | 26.83% | 35.15% | 35.19% | 9.39% | 9.41% | 20.43% | 20.44% | 48.48% | 48.53% |

(*Continued*)

**Table A1.** Continued.

| | Not working | Working | Not working | Agricultural work | Not working | Self-employed | Not working | Working for others | Not working | Single work activity | Not working | Multiple work activities |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Poor | 21.74% | 21.76% | 31.30% | 31.30% | 17.12% | 17.13% | 5.95% | 5.88% | 21.65% | 21.65% | 22.04% | 22.06% |
| Middle | 21.19% | 21.21% | 32.52% | 32.52% | 9.73% | 9.72% | 17.69% | 17.65% | 24.08% | 24.09% | 12.50% | 12.50% |
| Rich | 18.10% | 18.10% | 8.54% | 8.54% | 25.45% | 25.46% | 27.03% | 27.06% | 19.71% | 19.71% | 13.23% | 13.24% |
| Richest | 11.59% | 11.52% | 0.81% | 0.81% | 12.55% | 12.50% | 39.93% | 40.00% | 14.14% | 14.11% | 3.75% | 3.68% |
| *Residence* | | | | | | | | | | | | |
| Urban | 27.83 | 27.79 | 3.66 | 3.66 | 35.21 | 35.19 | 78.66 | 78.82 | 32.13 | 32.12 | 14.76 | 24.71 |
| Rural | 72.17 | 72.21 | 96.34 | 96.34 | 64.79 | 64.81 | 21.34 | 21.18 | 67.87 | 67.88 | 85.24 | 85.29 |
| *N* | 364 | 547 | 364 | 246 | 364 | 216 | 364 | 85 | 364 | 411 | 364 | 136 |

**Table A2.** Assessing the potential bias of omitted variables using Oster (2019).

| | Coefficient in OLS model without controls (Std. Error) [$R^2$] (1) | Coefficient in model re-weighted using entropy matching & including controls (Std. Error) [$R^2$] (2) | $R_{max}$ (3) | Identifying bound (4) | Within 95% confidence interval bound of model presented in column 2 (5) |
|---|---|---|---|---|---|
| Maternal work status | | | | | |
| Not working (ref) | | | | | |
| Working | −0.280** (0.067) [0.019] | −0.092 (0.062) [0.222] | 0.289 | −0.092, −0.091 | Yes |
| Maternal work category | | | | | |
| Not working (ref) | | | | | |
| Agriculture | −0.503**(0.072) [0.075] | −0.132 (0.074) [0.105] | 0.137 | −0.132, −0.132 | Yes |
| Not working (ref) | | | | | |
| Self-employed | −0.244**(0.085) [0.014] | −0.064 (0.077) [0.245] | 0.319 | −0.064, −0.064 | Yes |
| Not working (ref) | | | | | |
| Working for others | 0.273*(0.136) [0.009] | 0.081 (0.163) [0.201] | 0.261 | 0.080, 0.081 | Yes |
| Number of work activities | | | | | |
| Not working (ref) | | | | | |
| Single | −0.196* (0.074) [0.009] | −0.029 (0.065) [0.223] | 0.290 | −0.029, −0.029 | Yes |
| Not working (ref) | | | | | |
| Multiple | −0.535** (0.093) [0.063] | −0.289** (0.079) [0.216] | 0.281 | −0.289, −0.289 | Yes |

Notes: This table shows the results for the coefficient bounding exercise on omitted variable selection as proposed by Oster (2019). Column 1 comprises the baseline ordinary least square regression with standardized PPVT score at age 5 as the dependent variable and the maternal work variable as the single covariate. Column 2 comprises the entropy balancing models with child, maternal and economic contextual variables added as controls. Column 3 reports the estimated maximum $R^2$ from the hypothetical regression of standardized PPVT score on both observed and unobserved controls. As suggested by Oster (2019) this is calculated as 1.3 times the $R^2$ from the regression with controls (column 2). Column 4 reports the estimated bounds on maternal coefficient of interest using the controlled effect from column 2 and a recalculated effect assuming $\delta = 1$ and Rmax from column 3. Column 5 provides a summary of whether the identifying bound is within the 95% confidence interval of the OLS model in column 2.

**$p < 0.001$.

*$p < 0.05$.